# FUTURE FLIGHT

by Tech. Sgt. Mark Kinkade

*In 1903, Orville and Wilbur Wright combined existing technology and early avionic research with a desire to reach the sky and stay there. The result? The birth of powered flight. One hundred years later, the Centennial of Flight celebration winds down. The time to acknowledge the past is done. Now it's time to look to the future of flight.*

Pilots maneuver aircraft by thought. Helmet-mounted heads-up displays project a virtual reality "soundscape" of the battlefield. Unmanned aircraft launch strike missions on enemy forces while small hand-held robots flit around war zones like gnats, projecting enemy movement back to command centers.

Once, such ideas were the stuff of futurist ponderings published in popular science and mechanics magazines. Today, Air Force scientists and others say the dreams of the future are only a few microchips away from reality.

But let's scrap the idea of wildly fanciful but implausible artist renderings of bizarre aircraft flying on equally bizarre wingspans. Today's aviation engineers, scientists and researchers are looking at ways to keep the current warplane inventory up and flying well into the latter part of the century. After all, when you've got such strange looking airframes as the B-2 Spirit bomber, F-117 Nighthawk stealth fighter and now the F/A-22 Raptor strike aircraft, fanciful designs of future aircraft are a bit of a waste of time.

"We're not looking at science fiction ideas here," said Kristen Liggett, a crew systems engineer with the Air Force Research Laboratory's human effectiveness systems interface division at Wright-Patterson Air Force Base, Ohio. "We're talking science fact. What can we do to improve aircraft today, not 50 years from now?"

In other words, developers aren't looking forward to a day when technology will catch up to imagination. Today, technology is waiting for imagination to do what it does best: Create.

## In the cockpit

Most advanced avionics research in powered flight today falls into three areas: Integrating the pilot and the aircraft more comprehensively, aircraft design and function, and aircraft construction.

For generations of people raised on images of gallant fighter pilots using guts, instinct and a compass to fly and fight against airborne enemies, the concepts many researchers are developing are as cold and analytical as a computer on an iceberg. Forget Tom Cruise jockeying his F-14 Tomcat fighter like a cowboy on amphetamines. The aircraft of the not-so-future will take "seat of the pants" flying out of the cockpit.

"Today's cockpit is an information center," Liggett said. "The pilot has to assess a massive input of data in seconds to determine a course of action. We need to make that process easier. Instinct and courage are still in the equation, but pilots today also have much more information than pilots from other generations could have dreamed."

Helmet-mounted environment and targeting displays are old news in the advanced avionics world. Now engineers are working on ways to create three dimensional environments within the cockpit by using sound and visual techniques.

For example, Liggett's team is working on a project that will create a "surround sound" effect in the cockpit. When a threat appears, instead of a single monotonous tone beeping from the cockpit display, the tone will come from speakers in the general direction of the threat. The tone will act as a kind of reverse homing beacon, giving the pilot an auditory sense of which direction to focus his or her attention.

Also, scientists are looking at advanced voice control aspects of the cockpit, where a pilot will simply tell the aircraft what to do. Other projects involve look-and-shoot targeting and intelligence-aiding upgrades.

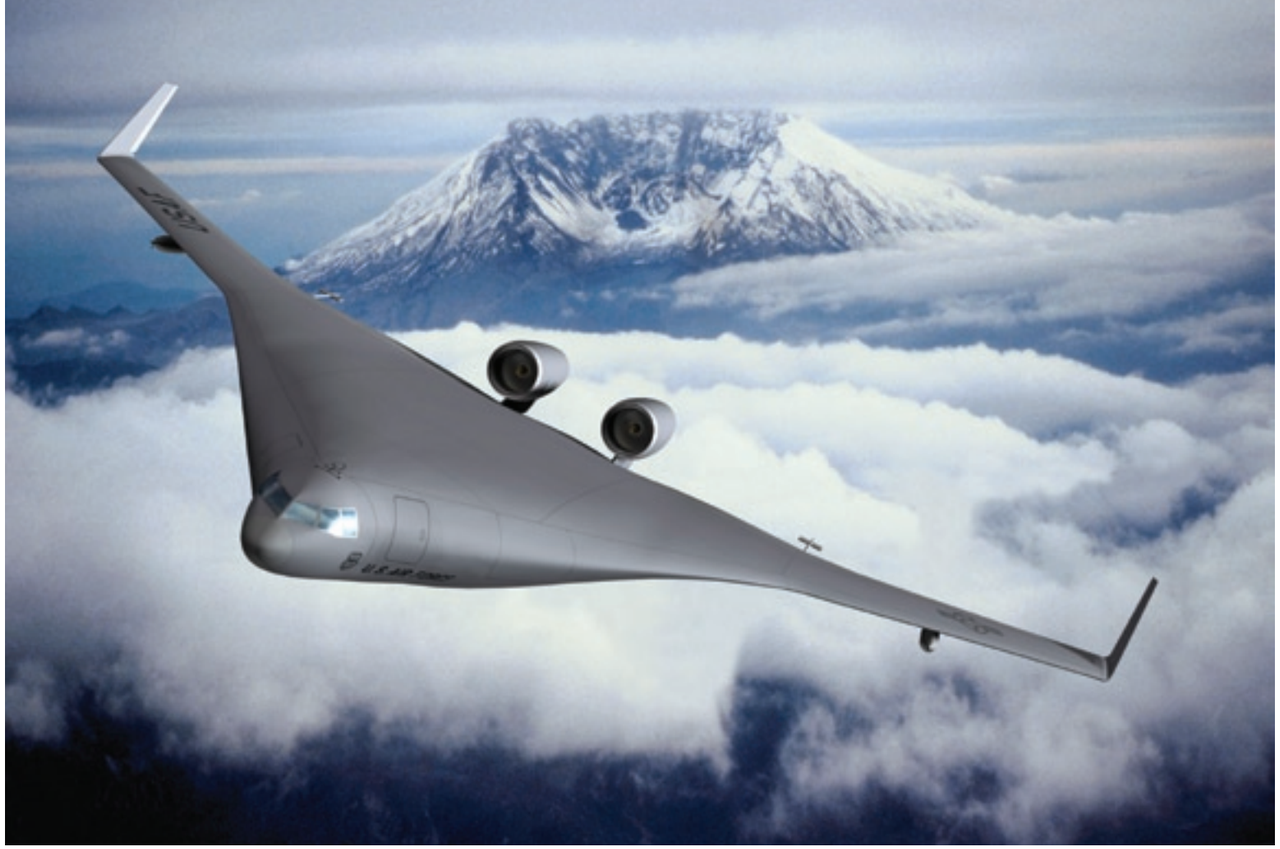
"To help the pilot do the job better, we look at ways to not only help with the physiological workload, but also the psychological workload," Liggett said. "Technology gives us tremendous opportunity to maximize the pilot's potential in the cockpit."

Current research could also lead to the ultimate in pilot/aircraft cohesion: thought-controlled aircraft.

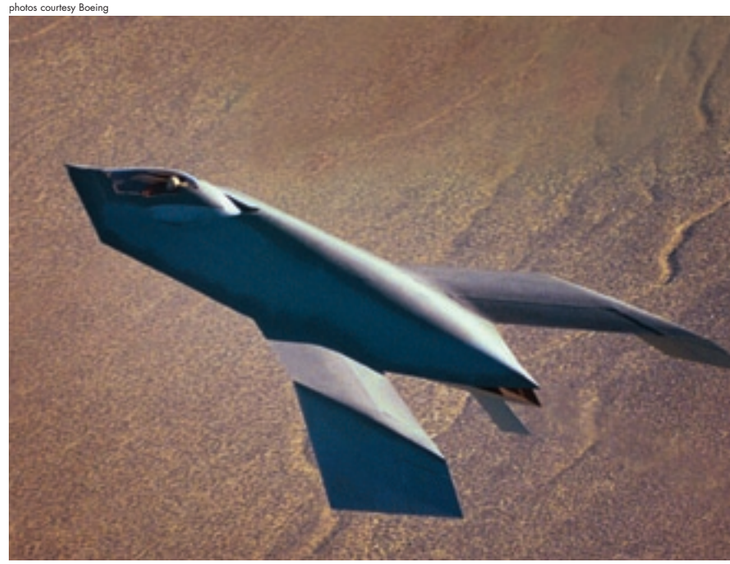
"There are those looking at 'brain control' of the aircraft," Liggett said. "A pilot flying a craft by thought. It's not as far-fetched as it seems."

## Wings of the future

In October, the first operational F/A-22 landed at Tyndall Air Force Base, Fla., marking the official operational debut of the next generation of powered military aircraft for the Air Force [See "F/A-22 Raptor Arrives at Tyndall," Page 8].



photos courtesy Boeing



***The blended-wing body concept*** *(above) is currently being studied as a research project that first began in the early 1990s. It's less like a traditional aircraft and more like a flying wing, which offers a greater lift-to-drag ratio than traditional designs and is structurally simpler. Because of its modular design, engineers could adapt it for use as a bomber; an intelligence, surveillance and reconnaissance aircraft; a global-range transport; a tanker and transport; and a gunship. If current research is an indicator, the next generation of fighter aircraft – such as the "Bird of Prey" stealth aircraft (right) – could represent the ultimate in human-machine integration. From three-dimensional sound and environment controls to look-and-shoot weapons direction and possibly even thought-controlled maneuvering, the next fighters could be an extension of the human pilot.*

The fighter joins the F-117 and B-2 as the primary weapons in tomorrow's air campaigns. Each aircraft was decades in development and represents the latest in technology advances.

But the air fleet of tomorrow may also include some veterans of campaigns past, most notably the B-52 Stratofortress bomber. Don't be surprised to see it streaking across the skies on bombing missions 30 years from now.

"Amazingly [there are plans for] an unprecedented service life for the B-52H of 84 years," said Williamson Murray, an Ohio State history professor who recently completed a study of future aircraft needs.

The B-52 could reach nearly a century of service through continued cockpit, avionics and

other upgrades under research at various places, including the Air Force Research Laboratory. But the bomber isn't the only aircraft researchers are planning for upgrades. There are already plans for updating the new Raptor's cockpit.

"We're talking about programs that will keep aircraft viable well into the future," said Jan Walker, a spokesperson for the Defense Advanced Research Projects Agency. "As technology advances, we want to be in position to take advantage of anything that will make the aircraft a superior platform."

Civilian companies are also looking to the future with new airframe designs in both fighter and transport aircraft. Northrop Grumman and Lockheed Martin, for example, unveiled a design for the research agency's quiet supersonic program. The aircraft is a strike aircraft that can go more than twice the speed of sound and fly nearly 6,000 nautical miles unrefueled.

Boeing Co. envisions a giant cargo aircraft called the "Pelican." With a 500-foot wingspan, the aircraft is designed to fly at just 20 feet above the sea, giving it a longer range — up to 10,000 nautical miles over water. Plans call for the aircraft to carry up to 1.5 million pounds of cargo, or the equivalent of 17 M-1 Abrams battle tanks.

"It is much faster than ships at a fraction of the operational cost of current airplanes," said Pelican program manager Blaine Rawdon.

## Wings but no pilots

Unmanned aircraft are getting a lot of attention, particularly after the success of Predator and Global Hawk aircraft in the war on terrorism. Light, fast, maneuverable and lethal without risk to a pilot, unmanned aircraft give war fighters a low-cost method of reducing an enemy threat.

Many research facilities are looking at various roles for future unmanned vehicles. Once primarily considered observation platforms, the use of such vehicles to hunt al Qaeda and Taliban forces in Afghanistan proved the vehicles can carry a lethal punch.

Some debate whether such aircraft will eventually replace manned aircraft. Most experts, however, agree the future Air Force will be a mix of both manned and unmanned aircraft, with the remote planes doing dirty details like flying into chemical contaminated environments, and long endurance reconnaissance and suppression of enemy air defenses missions.

"There are advantages and drawbacks to both," said William Scott, a Colorado-based aviation consultant. "Missions [for unmanned vehicles] will gravitate toward those compatible with their primary strengths — persistence, expendability and stealth."

Research is moving quickly to usher in a new generation of unmanned vehicles geared for combat missions. Called "unmanned combat air vehicles," these pilotless planes theoretically will take on the complex — but extremely dangerous — suppression missions, clearing the way for manned vehicles to operate over enemy territory with less risk. The first such craft, the X-45A, completed its first flight at Edwards in 2002.

Scott sees both types of unmanned aircraft filling roles in homeland defense, as well. A small remote plane could easily and stealthily tail terrorism suspects, fly routine reconnaissance patrols in threatened areas and serve as airborne eyes and radar for ground security teams.

Within the Defense Department, testing continues on an unmanned helicopter that can remain airborne for 30 hours. Also, researchers are looking at ways to use small unmanned drones as observation platforms for individual soldiers and small units in the field. As envisioned, a drone roughly the size of a milk jug could use helicopter dynamics to zip around buildings, through smoke and fog or over trees, hills and other obstructions to give soldiers a view of enemy positions.

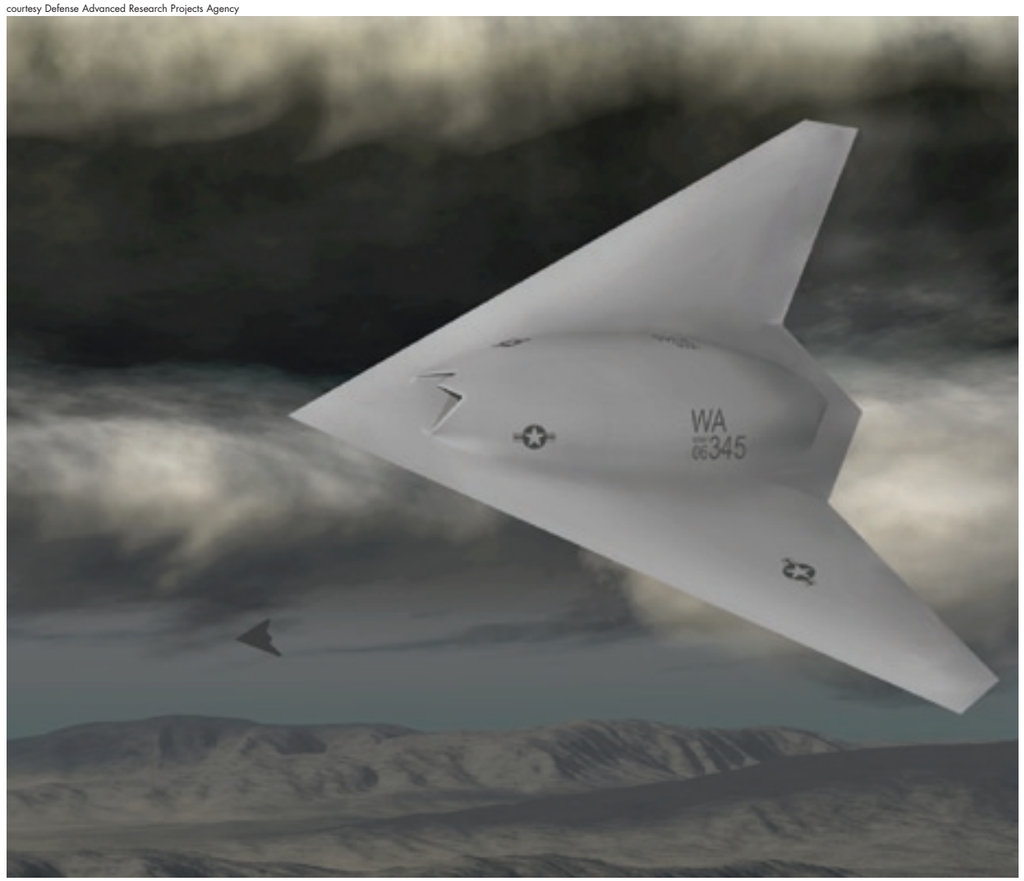
## We have the technology

Most aircraft design schemes call for advances on wing and fuselage shapes pioneered in today's stealth aircraft. Some futurists envision aircraft without wings that maneuver by thrusters mounted in the fuselage. Others see radical revisions of old designs, like updates to biplane wing construction and advanced helicopter mechanics.

Whatever the case, most futurists are drawing on existing technology to project future aircraft. John Peterson, president of The Arlington Group, a Virginia-based aviation think tank, sees a future when tiny robots build aircraft in seconds using a vat of goo and nanotechnology.

"Instead of making things from the top down," Peterson said, "there's a good chance we will make things from the bottom up."

courtesy Defense Advanced Research Projects Agency




***As technology improves,*** *the battlefield grows. The X-45C unmanned combat air vehicle, a concept aircraft based on the current X-45A, is designed to meet both the Air Force's evolving need for greater range and loiter capability and the Navy's requirements for potential carrier suitability and other Navy-unique needs. The X-45C will also have a larger payload capability, including the ability to carry two 2,000-pound joint direct attack munitions. The first flight of the X-45C air vehicle is scheduled for early 2006.*

Essentially, Peterson sees a time when tiny robots roughly the size of a molecule with sensors, computer code and an articulated arm, reproduce themselves by the billions in fractions of a second.

"For a given project, one of those tiny machines would be built and loaded with the very complex computer code that describes the material, shape, finish and other characteristics of the final product," he said. "Then that first machine would make another of itself, the two make four and so on. In seconds, you would have literally billions of the machines."

Then the machines would begin working on whatever project has been encoded in their computer code. Imagine a vat slightly larger than the average fighter jet. Technicians pump in a slurry of materials, organic compounds and other elements needed in aircraft production, but in liquid form. Now someone adds a single nanotech machine. Less than one minute later, a new fighter aircraft, built entirely from the elements in the slurry and by billions of tiny machines, stands in the vat.

Fantastic? Sure. Possible? Peterson thinks so.

"The significance of this possible revolution cannot be overestimated," he said. "When the very essence — the atomic configuration — of materials can be determined, an extraordinary [array] of possibilities opens up in many areas." ✪